

## Patent claims

1. Fuel concentration increasing device for increasing the concentration (5) of a fuel in a liquid mixture of a fuel and a carrier component

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having at least one fuel storage device (1) in which the fuel is storable and

10 having at least one throughflow device (2) which is disposed at least partially in the fuel storage device (1) for conducting the mixture of fuel and carrier component through the fuel storage device (1),

15 the throughflow device (2) containing at least one membrane which is permeable or semi-permeable for the fuel but not for the carrier component or comprising such a membrane so that, because of the transport properties of the membrane, fuel can be added passively to the liquid mixture of fuel and carrier component.

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2. Device according to the preceding claim,

characterised in that

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the device is disposed on a fuel cell and/or has a fuel exchange connection to a fuel cell for exchanging the mixture of fuel and carrier component.

3. Device according to the preceding claim,

characterised in that

5 the fuel cell is a direct methanol fuel cell.

4. Device according to one of the claims 2 or 3,

characterised in that

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water produced on the cathode of the fuel cell can be coupled into the mixture of fuel and carrier component.

5. Device according to one of the preceding claims,

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characterised in that

20 a heating device is disposed on the device in order to heat fuel stored in the fuel storage device (1) and/or the mixture of fuel and carrier component and/or in that the device is connected thermally or physically to a fuel cell.

6. Device according to one of the preceding claims,

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characterised in that

heat insulation is integrated in the fuel storage device (1) or disposed thereon.

7. Device according to the preceding claim,  
characterised in that  
5 the heat insulation contains or comprises insulating material  
and/or in that the heat insulation has walls together with a  
vacuum situated therebetween.
8. Device according to one of the preceding claims,  
10 characterised in that  
the mixture of carrier component and fuel can be conducted  
through the throughflow device (2) more than once for a multiple  
15 increase in the concentration (5) of the fuel in the mixture.
9. Device according to one of the preceding claims,  
20 characterised in that  
the fuel storage device (1) contains or comprises a container  
and/or a tank.
10. Device according to one of the preceding claims,  
25 characterised in that  
the fuel storage device (1) contains fuel in pure or in concentrated  
form.  
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11. Device according to the preceding claim,

characterised in that

5           the fuel storage device (1) contains fuel in a carrier component,  
          the fuel being present in 50 to 100 per cent, preferably 75 to 100  
          per cent concentration.

12. Device according to one of the preceding claims,

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characterised in that

at least one support device and/or stabilising device is disposed  
in the fuel storage device (1).

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13. Device according to the preceding claim,

characterised in that

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at least one of the disposed support or stabilising devices  
contains or comprises foamed material.

14. Device according to one of the preceding claims,

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characterised in that

the membrane contains or comprises a perfluorosulphonic  
acid/polytetrafluoroethylene copolymer in acidic ( $H^+$ ) form.

15. Device according to one of the preceding claims,

characterised in that

5           the throughflow rate for the mixture of carrier component and  
fuel through the throughflow device (2) has an order of  
magnitude in the range of 0.1 ml/min to 1000 ml/min,  
preferably 1 ml/min to 100 ml/min.

10         16. Device according to one of the preceding claims,

characterised in that

15           a support device is disposed on or around the throughflow device  
(2) in order to achieve an arbitrary spatial orientation of the  
throughflow device (2).

17. Device according to the preceding claim,

20           characterised in that

the support device contains or comprises foamed material.

18. Device according to one of the preceding claims,

25           characterised in that

the throughflow device (2) contains or comprises at least one  
channel.

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19. Device according to the preceding claim,

characterised in that

5 the channel has a circular cross-section.

20. Device according to one of the preceding claims,

characterised in that

10 at least one filter is disposed in the throughflow device (2).

21. Device according to one of the preceding claims,

15 characterised in that

the carrier component and/or the fuel contains or comprises a liquid.

20 22. Device according to one of the preceding claims,

characterised in that

25 the carrier component contains or comprises water, water vapour and/or a mixture thereof with further materials.

23. Device according to the preceding claim,

characterised in that

30 the carrier component contains furthermore an acid, preferably sulphuric acid.

24. Device according to one of the preceding claims,

characterised in that

5 the fuel contains or comprises an alcohol.

25. Device according to the preceding claim,

characterised in that

10 the fuel contains or comprises methanol and/or ethanol.

26. Fuel concentration increasing method for increasing the concentration of a fuel in a liquid mixture of a fuel and a carrier component,

15 at least one throughflow device (2) being disposed at least partially in a volume filled with fuel and

20 the mixture of fuel and carrier component being conducted through the at least one throughflow device (2) containing or comprising a membrane which is permeable or semi-permeable for the fuel but not for the carrier component so that, because of the transport properties of the membrane, fuel is added passively 25 from the volume of the mixture of the fuel and the carrier component.

27. Method according to the preceding claim,

30 characterised in that

a device according to one of the claims 1 to 25 is used.

28. Method according to one of the claims 26 or 27,

characterised in that

5           the mixture of fuel and carrier component is conducted through  
              the throughflow device (2) more than once for multiple increase  
              in the concentration of the fuel in the mixture.

29. Method according to one of the claims 26 to 28,

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characterised in that

the mixture of fuel and carrier component is conducted to the  
anode of a fuel cell after the increase in the concentration.

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30. Method according to one of the claims 26 to 29,

characterised in that

20           water produced on the cathode of a fuel cell is re-used in that it  
              is introduced into the mixture of fuel and carrier component.

31. Method according to one of the claims 26 to 30,

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characterised in that

the fuel and/or the mixture of fuel and carrier component and/or  
the carrier component are heated.

32. Method according to one of the claims 26 to 31,  
characterised in that  
5           the mixture of carrier component and fuel is filtered before  
             and/or after being conducted through the throughflow device (2).
33. Use of a device according to one of the claims 1 to 25 for  
modifying the fuel supply flow to the anode of a fuel cell.  
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34. Use according to the preceding claim for direct methanol fuel  
cells.
35. Use of a method according to one of the claims 26 to 32 for  
modifying the fuel supply flow to the anode of a fuel cell.  
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36. Use according to the preceding claim for direct methanol fuel  
cells.
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